

## Written HW Week 8

$$\begin{aligned}\text{Initial: Total energy} &= KE + PE \\ &= \frac{1}{2}mv_0^2 + mgh = E\end{aligned}$$

At top of highest possible "jump",  $v = v_s$ , but total energy is the same:

$$E = \frac{1}{2}mv_s^2 + mgH.$$

Set these equal, solve for H:

$$\frac{1}{2}mv_0^2 + mgh = \frac{1}{2}mv_s^2 + mgH \quad (m \text{ cancels!})$$

$$\frac{1}{2}v_0^2 + gh - \frac{1}{2}v_s^2 = gH$$

(Simplify, divide by g:)

$$\boxed{\frac{1}{2g}(v_0^2 - v_s^2) + h = H}$$

(a) Filling in numbers:  $v_0 = 45 \frac{m}{s}$   $v_s = 30 \frac{m}{s}$ :

$$\frac{1}{9.8 \frac{m}{s^2}} \left( [45 \frac{m}{s}]^2 - [30 \frac{m}{s}]^2 \right) + 50 m = \boxed{107 m.}$$